

Spermoderm pattern in Hedysareae (Fabaceae) and its systematic implications

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Abstract

SEM studies in 19 taxa belonging to 9 genera of Hedysareae (Papilionoideae, Fabaceae) show that there are at least five major types of seed surface patterns in this tribe, namely rugulate, foveo-rugulate, lophate, reticulate and tuberculate. It is concluded that this taxon, as treated by Bentham and Hooker, is heterogenous and that its treatment by Polhill is more natural.

INTRODUCTION

Scanning electron microscopic studies on spermoderm pattern in Papilionoideae have been carried out by some workers (see Lersten 1979, 1981; Kumar and Rangaswamy 1984; Jha and Pandey 1988; Pandey and Jha 1988a, b, 1989; Trivedi *et al.* 1978a, b, 1980; Trivedi and Bagchi 1982). However, excepting a few reports (Lersten 1981; Jha and Pandey 1988; Pandey and Jha 1989) the seed coat surface patterns in the tribe Hedysareae (*sensu lato*) have not been adequately studied, especially in relation to the natural relationship of the member taxa. The objective of the present paper is to evaluate spermoderm patterns in the member genera of the tribe Hedysareae with the aim of deducing taxonomic affinities within the tribe, based on the patterns displayed by selected representative species in each genus.

MATERIALS AND METHODS

Mature seeds of *Aeschynomene aspera* L., *A. indica* L., *Alysicarpus bupleurifolius* DC., *A. longifolius* W. & A., *A. monilifer* DC., *A. rugosus* DC., *A. vaginalis* Wall., *Smithia conferta* Sm., *Uria picta* Desv. and *Zornia gibbosa* Spanoghe were collected from Santhal Pargana forests of Bihar. Seeds of *Aeschynomene sensitiva* Beauv., *Alhagi maurorum* Medic. *Hedysarum coronarium* L., *H. spinosissimum* L., *Onobrychis alba* Desv., *O. pulchella* Shrenk., *Ornithopus compressus* and *Uria macrostachya* wall. were obtained from Royal Botanic Gardens, Kew, England. Seeds of *Uria hamosa* wall. were obtained from National Botanical Research Institute, Lucknow. The mature seeds were mounted on brass stubs with a double adhesive tape and then coated with a layer of gold (200 nm) in sputter coating

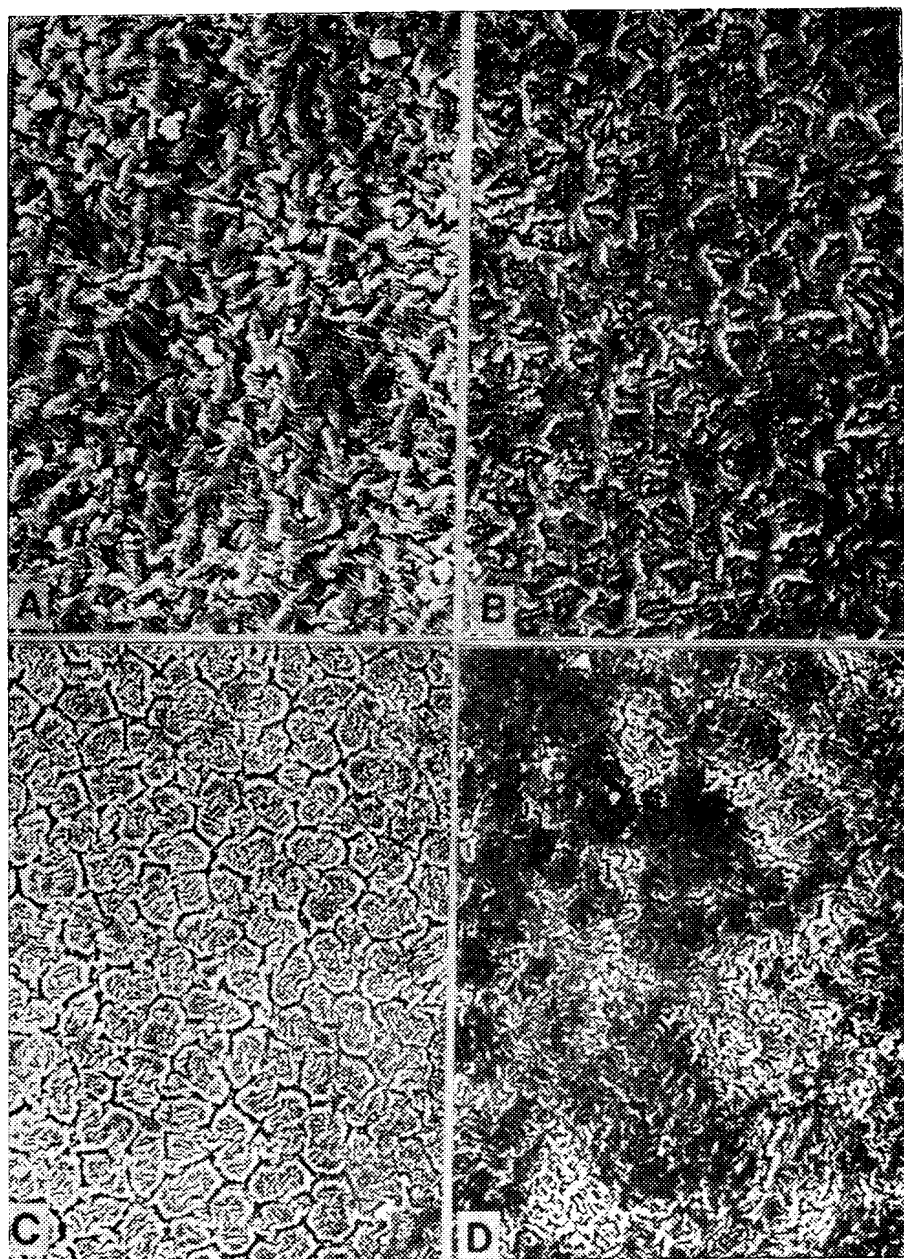


Fig. 1 A-D. Scanning electron micrographs of spermoderm. A. *Alhagi maurorum* X 2000. B. *Aeschynomene indica* X 2000. C. *Alysicarpus vaginalis* X 2000. D. *Hedysarum coronarium* X 2000.

unit. Scanning was done on Jeol JSM 35C SEM at National Botanical Research Institute, Lucknow. The region subjacent to hilum was scanned at a constant tilt (45°) at an accelerating potential of 15 KV.

OBSERVATIONS

Alhagi Adans.

Seeds show reticulate spermoderm (Fig. 1A). The reticulae are covered by diagonally oriented cuticular striations which mask the underlying reticulae to a considerable extent. Irregularly distributed flakes of waxy deposition are seen over the spermoderm surface.

Aeschynomene Linn.

The spermoderm is rugulate having raised ridges with irregular sides having a tendency towards forming a reticulate pattern (Fig. 1B). The rugae are of two types: (i) small and thin rugae which lie at the surface, and (ii) robust and large rugae which are raised and appear to form a reticulum. In *A. aspera* and *A. indica* the raised rugae are not so closely packed as in *A. sensitiva*.

Alysicarpus Neck.

The spermoderm is rugulate in *A. bupleurifolius*, *A. rugosus* and foveo-rugulate in *A. longifolius*, *A. monilifer* and *A. vaginalis*. In *A. bupleurifolius* and *A. rugosus* the rugae are closely knit and they tend to form reticulae which are spread over the entire seed coat surface. The walls of such reticulae are not straight. In the species where spermoderm is foveo-rugulate, seed surface shows distinct polygonal areas which are separated by narrow grooves and each polygonal area has its own rugae (Fig. 1C). In *A. longifolius* foveoles are not deep and rugae are not very distinct due to heavy deposition of waxy material. The waxy deposition fills the furrows and even covers the individual cells in such a way that the spermoderm appears smooth in those areas. In *A. monilifer* and *A. vaginalis* the grooves in between the polygonal areas are quite distinct.

Hedysarum Linn.

The spermoderm pattern is rugulate (Fig. 1D). The rugae are evenly thickened and distinct.

Onobrychis Linn.

The spermoderm is rugulate in *O. alba* and tuberculate in *O. pulchella* (Fig. 2A). In the former the rugae are well-developed and tend to form a reticulum. In the latter species, tubercles are of two types: larger and smaller. The lower end of tubercles are drawn into elongated processes.

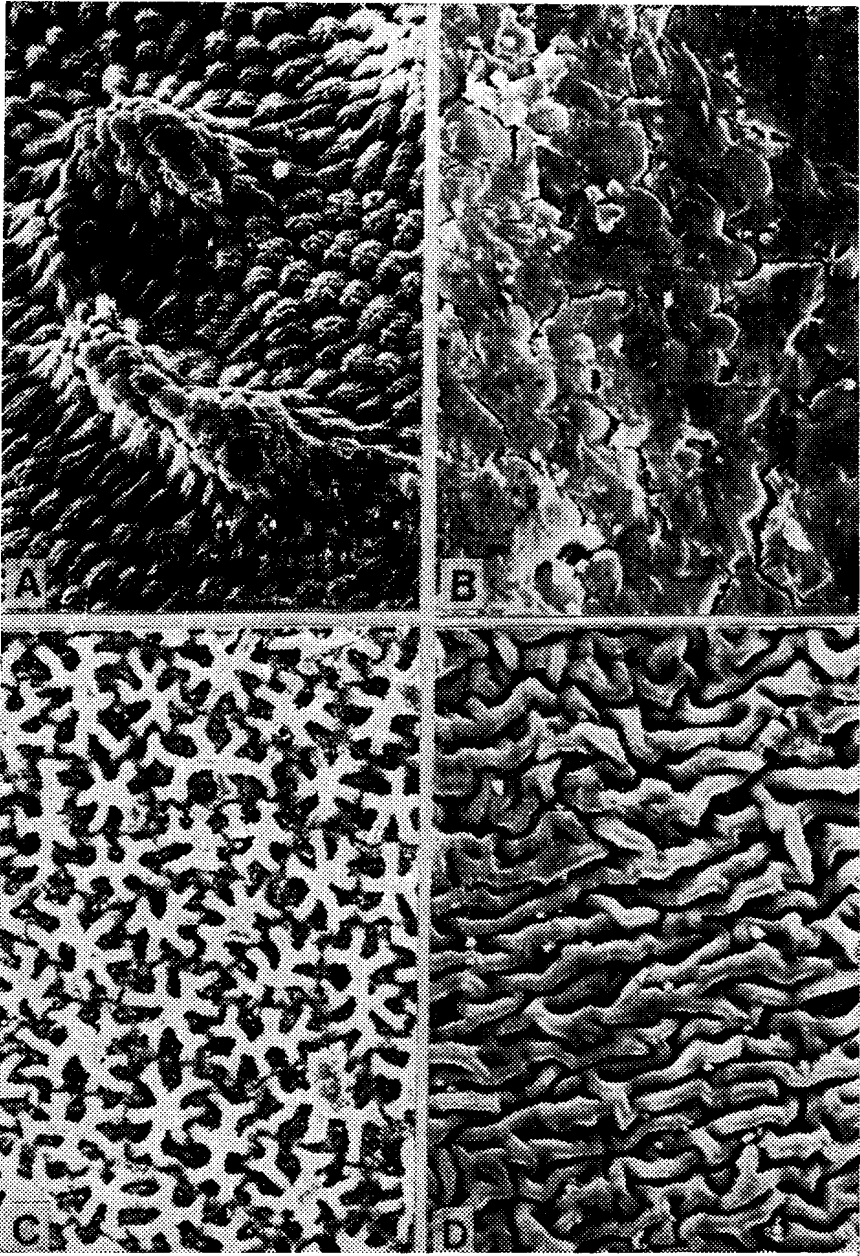


Fig. 2 A—D. Scanning electron micrographs of spermoderm. A. *Onobrychis pulchella* X 1000. B. *Ornithopus compressus* X 2000. C. *Smithia conferta* X 2000. D. *Zornia gibbosa* X 3000.

Ornithopus Linn.

The spermoderm is tuberculate (Fig. 2B). The tubercles are low dome-shaped.

Smithia Ait.

The spermoderm is lophate (Fig. 2C). The rugae form short ridges with irregular sides.

Uraria Desv.

The spermoderm is foveo-rugulate, and shows distinct, polygonal areas separated from one another by distinct grooves. The polygonal areas are, however, interconnected by means of narrow and wide processes. The rugae which are superimposed on the foveoles are quite distinct and sometimes merge to form larger rugae. In *U. macrostachya* the rugae of one polygonal area sometimes elongate to such an extent that they meet the rugae of the neighbouring polygons. Flakes of waxy deposition are discernible here and there over the spermoderm. In *U. picta* the spermoderm shows large and small polygonal areas. The large polygonal areas show a tendency towards forming low dome-shaped structures. The smaller ones show distinct rugae superimposed upon a foveolate pattern.

Zornia Gmel.

The seeds show rugulate spermoderm (Fig. 2D). The rugae are quite distinct, smooth and interwoven.

DISCUSSION

The tribe Hedysareae is of interest as it shows rugulate, foveo-rugulate, lophate, reticulate and tuberculate spermoderm patterns. In *Aeschynomene* the spermoderm is rugulate, a feature also reported by Lersten (1981) in *Aeschynomene indica*. The seeds of *Alhagi maurorum* show a reticulate testa surface. *Alhagi persarum*, on the other hand, shows a multireticulate spermoderm (Lersten, 1981). In *Alysicarpus* the spermoderm pattern varies from rugulate to foveo-rugulate. Lersten (1981) described rugulate spermoderm in *Alysicarpus vaginalis*. Our samples, however, reveal a foveo-rugulate spermoderm in this species.

Lersten (1981) studied 10 species of *Onobrychis* and reported simple-foveolate, multi-foveolate, multi-reticulate and pitted spermoderm patterns. During present investigation of *Onobrychis alba* and *O. pulchella* rugulate and tuberculate spermoderm patterns have been observed, which probably suggest wide variations in this character in the member species.

Seeds of *Hedysarum coronarium* and *H. spinosissimum* show a rugulate pattern. Lersten (1981), however, observed substriate spermoderm in *H. alpinum*. Two sets of observations differ only slightly in as much as the substriate and the rugulate patterns of spermoderm can only be regarded as variations of one basic pattern. Such variations can be correlated with the growth of seeds in relation to the cuticular deposition.

Seeds of *Uria hamosa*, *U. macrostachya* and *U. picta* examined show remarkably similar spermoderm pattern, i. e. foveo-rugulate. *Zornia gibbosa* shows a rugulate spermoderm, as was also reported by Lersten (1981). Spermoderm in *Ornithopus compressus* is tuberculate. Lersten (1981) recorded simple reticulate spermoderm ornamentation in *Ornithopus sativus*.

Bentham and Hooker (1865) included *Aeschynomene*, *Alhagi*, *Alysicarpus*, *Hedysarum*, *Onobrychis*, *Ornithopus*, *Smithia*, *Uria* and *Zornia* in the tribe Hedysareae. Hutchinson (1964) placed *Aeschynomene* and *Smithia* in the tribe Aeschynomeneae, *Alhagi*, *Hedysarum* and *Onobrychis* in Hedysareae, *Alysicarpus* and *Uria* in Desmodieae, *Ornithopus* in Coronilleae and *Zornia* in Stylosantheae. Polhill (1981) placed *Alysicarpus* in Desmodieae, *Aeschynomene*, *Smithia* and *Zornia* in Aeschynomeneae, *Hedysarum* and *Onobrychis* in Hedysareae, *Ornithopus* in Coronilleae and *Alhagi* in Galegeae. In seed anatomical features all the taxa of Hedysareae are remarkably similar (Jha and Pandey 1988; Pandey and Jha 1989), but they differ considerably in seed morphology (Pandey, unpublished) and spermoderm pattern (present study). The members of tribe Hedysareae (s. l.) show differences in chemical, wood anatomical, embryological, palynological and cytological characters also (see Narayana and Kumari 1984). Present study on the spermoderm patterns in this tribe reveals great variations, which lend support to Polhill's (1981) realignment of the taxon as detailed above.

Acknowledgements

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